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# Impact of patient demographics on control of Asthma in outpatients accessible at the various community pharmacies in Pakistan

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## ABSTRACT

**Background:** Asthma is a public health issue worldwide. Specific demographics influence asthma control, as the condition can vary between countries depending on different factors. **Objective:** This study aimed to determine the effect of different demographics on the control of Asthma in different community pharmacies in Lahore, Pakistan. **Methods:** A cross-sectional observational study was undertaken in a community pharmacy located in Lahore city to assess Asthma control based on symptom improvement parameters. The study evaluated the control rate using a validated data collection form. Statistical analysis was conducted using SPSS version 24.0. Post-hoc pairwise comparison of the chi-squared test was employed to analyze various variables in relation to asthma control in patients. The effect size was determined using Phi and Cramer's v. **Results:** A statistically significant association ( $p < 0.001$ ) was found between asthma control and patients' gender. Post-hoc pairwise comparison of the chi-square test revealed a direct positive significant association between asthma control and patients' age, with a p-value of 0.001. A statistically strong positive association was observed between age and the impact of asthma control on the sample population. Similarly, the use of formoterol resulted in better asthma control in the population, with a p-value of 0.008 and a moderate positive association effect size (0.258) between the type of inhaler and asthma control. However, smoking did not show a significant association with asthma control in the current research ( $p = 0.478$ ). On the other hand, education level demonstrated a direct positive effect on asthma control, with a p-value of 0.001 and an effect size

of 0.288. *Conclusion:* In conclusion, the current study shows that a number of different variables are having a positive effect on asthma control patients visiting community pharmacies for their medication. More importantly, females have better control of disease than males.

**Keywords:** Asthma control, demographic variables, adherence of patients, smoking, community pharmacies

## 1. INTRODUCTION

Many non-communicable diseases are spreading day by day and causing multiple complications for the people of the world (Upadhyay 2022). Noncommunicable diseases; Asthma is one of them, most common in children (Budreviciute et al., 2020). Asthma has a heterogeneous nature, chronic disorder, and severe inflammation in airways with hypersecretions (Padem and Saltoun, 2019). Asthma is a disease affecting the lower respiratory system of people (Driscoll et al., 2020). The mechanism of Asthma is not entirely understood, presenting common symptoms of inflammation, chest tightness, coughing, and wheezing (Mandlik and Mandlik, 2020). Bronchoconstriction due to mediators like histamine, prostaglandins, kinins, and leukotrienes increases microvascular leakage and mucous production, activating signaling pathways of mucociliary clearance through Toll-like receptors (Rand et al., 2012).

The Asthma is diagnosed by symptoms and lung function test's (Danvers et al., 2020). Two significant components of the objective diagnosis are (1) evidence of obstruction and (2) variable in the degree of obstruction demonstration (Brigham and West, 2015). The diagnostic tests for Asthma are spirometry, bronchodilator reversibility, fractional inhaled nitric oxide, peak respiratory flow rate, and bronchial challenge tests (Devani et al., 2022). The mortality and morbidity rate of asthma patients is increasing day by day, and the risk factor is polluted environmental conditions (Chatkin et al., 2022). About 335 million people have Asthma worldwide due to different risk factors (Phan et al., 2020). According to the literature, in the Netherlands, about 3.7% of people have severe Asthma (Toor et al., 2021).

The prevalence of people who have Asthma in males is about 55.7% higher than in females about 44.3% in KPK, Pakistan. In 2021, 14% of children in Karachi schools have Asthma (Shimba and Ikuta, 2020). The proper prescription pattern of anti-asthmatic medication is required for the reduction in the severity of Asthma (Alolayan, 2021). Also crucial to monitoring is the rational use of drugs. The TAI toolkit and collaboration of health care providers make effective medication therapy for asthma patients and increase medication adherence (Hei et al., 2021). The prescription pattern of anti-asthmatic medications is according to the patient's condition (Gawali et al., 2021). People were followed (1) quick relief therapy with inhaled corticosteroids, (2) reliever therapy with beta-agonist (3) add-on therapy with long-acting muscarinic antagonist (Cloutier et al., 2021).

The medication to control Asthma and reduce the symptoms, inhaled corticosteroids use is well known (Hu et al., 2021). For immediate ease of symptoms, mostly short-acting beta-agonists (SABA), are prescribed (Papi et al., 2020). The long-acting beta-agonist (LABA), SABA, long-acting muscarinic antagonist (LAMA), and inhaled corticosteroids (ICS) are mainly prescribed drugs for patients having Asthma. The stages of Asthma are depended on the duration and frequency of asthma attack, the stage is starting from intermittent to mild-moderate persistent and severe Asthma (Cicco et al., 2021). Anti-asthmatics medication with a brand name prescribed in children; ICS is prescribed more in children with persistent Asthma than children with intermittent Asthma (Kaur et al., 2020).

In Nigerian teaching hospitals attending asthmatic patients aged <10 years, the most prescribed drug is an antihistamine in a five-year retrospective survey. The socio-economic cost of Asthma in Europe is about 1,900 US dollars lower than the cost in USA, which is about 3,100 US dollars (Nunes et al., 2017). The cost of asthma increases with the increase in the stages of Asthma from excessive cost in severe Asthma (Song et al., 2020). The primary issue with corticosteroids is that they weaken the immune system (Shimba and Ikuta, 2020). Quality of life, of patients is reduced due to the various adverse effects on eyes, growth, and respiratory tract (Heffler et al., 2018). The long-term use of corticosteroids and withdrawal of corticosteroids without taper-off therapy cause adverse effects, mostly myopathy with glucocorticoids (Gupta and Gupta, 2013).

Other adverse effects due to glucocorticoids are slow wound healing, osteoporosis, immune system suppression, high blood pressure, and insulin resistance (Silver and Ochoa, 2018). New biologics introduced for patient compliance with asthma therapy that targets interleukin IL-5, IL-4, and IL-13 receptors (Eger and Bel, 2019). To check the prescription pattern of asthma patients and impact of different demographic factors to control Asthma. Control of Asthma is necessary for the rational use of medication and improve quality of life and compliance of patients. The main objective of treating anti-asthmatic drugs is to get relief from the drastic symptoms and resolve the chief

complaint. Asthma, a chronic lung disorder, requires the patient's adherence to anti-asthmatic medications. There is a need for follow-up by patients suffering from this disease. Here, community pharmacies play a vital role in their drug distribution setups.

## 2. MATERIALS AND METHODS

The present study is a multicenter investigation of multiple community pharmacies in Lahore, one of the biggest and most significant cities in Pakistan. A pre-validated data collection instrument was utilized in this cross-sectional observational study, together comments and reactions from patients at several community pharmacies. The study took place between December 12, 2022, and June 22, 2023, a period of seven months. The primary objective of this study was to evaluate how people with asthma use prescribed drugs and how their condition is managed in those who have been taking these drugs regularly for a long time from different community pharmacies in Lahore. The study looked into the connection between a number of demographic factors and outpatients' ability to control their condition.

The purpose of the study was to look at the type of treatment, how often it is administered, how well patients adhere to their treatment plans, and which particular patients with asthma have been prescribed medication. The local pharmacies where individuals purchased their prescription drugs provided the data for this study. Initially, 96 patients were the object of the study, which used a stratified convenience sample technique. Six age groups of patients were identified: under five years old, 5-14 years old, 15-30 years old, 31-44 years old, 45-64 years old, and over 65 years old. Mothers who declined to participate or were expecting did not participate in the study. A thorough questionnaire that covered the patients' biographical details, family history, mental health history, symptoms, type of treatment, and length of treatment was used to collect data. The technique of collecting information was overseen by qualified chemists in Pakistan.

Pharmacies were picked at random, and before selection, each pharmacy had to have participants' informed consent. Detailed responses were provided for each question. Each eligible participant was informed of the significance and implications of the research after it obtained ethical approval. The selected research subjects were then asked for consent, with a focus on the study's ethical issues. Each neighboring pharmacy provided at least five prescriptions, and during patient interviews, all pertinent data was documented on a data-collection sheet. People who had been diagnosed with the illness and had a complete medication history that included information about their age, sex, race, family history, marital status, and past and current medical history were asked to provide their consent. Lahore Pharmacy College, located in Lahore, Pakistan, approved the research under ethical approval with reference number MZI/46/22.

### Statistical analysis

The experiment data was presented in both descriptive and analytical formats, with statistical analysis conducted using SPSS version 24.0. A significance level of  $P < 0.05$  was applied to determine statistical significance. Non-parametric statistical analysis, which explores the relationship between a dependent variable and asthma control, was utilized. The analysis of asthma control data involved employing a chi-square test to ascertain the p-values of various variables. In the Current study statistical significance standard for the P value was set less than 0.05 for any kind of direct positive or negative relationship in variables. Additionally, the effect size was computed using Phi and Cramer's V in the non-parametric analysis. These measures adjust the chi-square significance to account for sample size differences.

## 3. RESULTS

In our study 149 patients with asthma recruited from various community pharmacies, in Lahore. Female patients had a higher participation rate than males. About 58.4% patients have adherence with asthma medications. The further information of the respondents represented in (Table 1). The study shows the impact of social demographics of patient on the control of Asthma. Approximately 51.0% of male participants are suffering with asthma. Only 30.9% of the patients are university students. Furthermore, around 52.3% of patients are using formoterol inhalers. Detailed information can be obtained from Table 1 below.

**Table 1** Demographic information of patients. (N=149)

Gender of respondents	
Male	76 (51.0)
Female	73 (49.0)
Age	
20 to 40 years	52 (34.9)
40 to 60 years	69 (46.3)
80 and above	28 (18.8)
Marital Status	
Single	26 (17.4)
Married	38 (25.5)
Divorced	74 (49.7)
Widow	11 (7.4)
Daily Exercise	
Yes	18 (12.1)
No	131 (87.9)
Smoking	
Yes	29 (19.5)
No	120 (80.5)
Patient Education	
Pre-college	67 (45.0)
College	36 (24.2)
University	46 (30.9)
Employment status	
Not employed	29 (19.5)
Self employed	61 (40.9)
Government employed	37 (24.8)
Private employed	22 (14.8)
Obesity	
Yes	66 (44.3)
No	83 (55.7)
Type of inhaler Administration	
Salbutamol only	37 (24.8)
Salbutamol and Beclomethasone	34 (22.8)
Formoterol	78 (52.3)
Patient Adherence	
Yes	87 (58.4)
No	62 (41.6)

Female participants in our present study have more asthma control (56.2%) as compared to males. In the same way, patients with ages 20 to 40 years had more control on disease (86.5%) as compared to the other aged groups of the study ( $P = 0.001$ ,  $p +0.352$ ). Similarly, patients who exercise demonstrated better disease control, with 96 individuals (73.3%) achieving favorable outcomes compared to those who do not exercise. Conversely, no significant association was found between smokers and non-smokers regarding asthma control ( $P = 0.478$ ). Further aspects can be found in Table 2 below.

**Table 2** Post-hoc pairwise comparison of chi-squared tests for different variables with control of disease in 149 patients.

Variables	Disease Control (N %)		P- value*	Effect size#
	Yes	No		
Gender				
Male	46 (43.8)	30 (68.2)	0.007	0.222
Female	59 (56.2)	14 (31.8)		
Age				
20 to 40 years	45 (86.5)	7 (13.5)	<0.001	0.352
41 to 60 years	49 (71.0)	20 (29.0)		
61 and above	11 (39.3)	17 (60.7)		
Marital Status				
Single	21 (80.8)	5 (19.2)	0.092	0.028
Married	21 (55.3)	17 (44.7)		
Divorced	54 (73.0)	20 (27.0)		
Widow	9 (81.8)	2 (18.2)		
Daily Exercise				
Yes	9 (50.0)	9 (50.0)	0.042	0.042
No	96 (73.3)	35 (26.7)		
Smoking				
Yes	22 (75.9)	7 (21.1)	0.478	-
No	83 (69.2)	37 (30.8)		
Patient Education				
Pre-college	37 (55.2)	30 (44.8)	0.001	0.288
College	29 (80.6)	7 (19.4)		
University	39 (84.8)	7 (15.2)		
Employment status				
Not employed	17 (58.6)	12 (41.4)	0.275	-
Self-employed	42 (68.9)	19 (31.1)		
Government	28 (75.7)	9 (24.3)		
Private	18 (81.8)	4 (18.2)		
Obesity				
Yes	36 (54.5)	30 (45.5)	<0.001	0.311
No	69 (83.1)	14 (16.9)		
Type of inhaler Administration				
Salbutamol only	24 (64.9)	13 (35.1)	0.008	0.258
Salbutamol and Beclomethasone	18 (52.9)	16 (47.1)		
Formoterol	63 (80.8)	15 (19.2)		
Patient Adherence				
Yes	69 (79.3)	18 (20.7)	0.005	0.230
No	36 (58.1)	26 (41.9)		

\* The null hypothesis was evaluated using the Chi-square test, specifically through post-hoc pairwise comparisons. Effect sizes were determined using Phi and Cramer's V coefficients, vary from 0.0 to 1. A value of 0.0 signifies no relation in variables, while a value of 1 shows a good relation.

There is a clear gender gap in asthma control, with females consistently showing superior disease control compared to males. Females tend to have higher average asthma control scores, indicating more effective symptom management and fewer exacerbations. Conversely, males typically exhibit lower levels of asthma control, suggesting challenges in effectively managing their condition. Further description can be found in Figure 1 below:

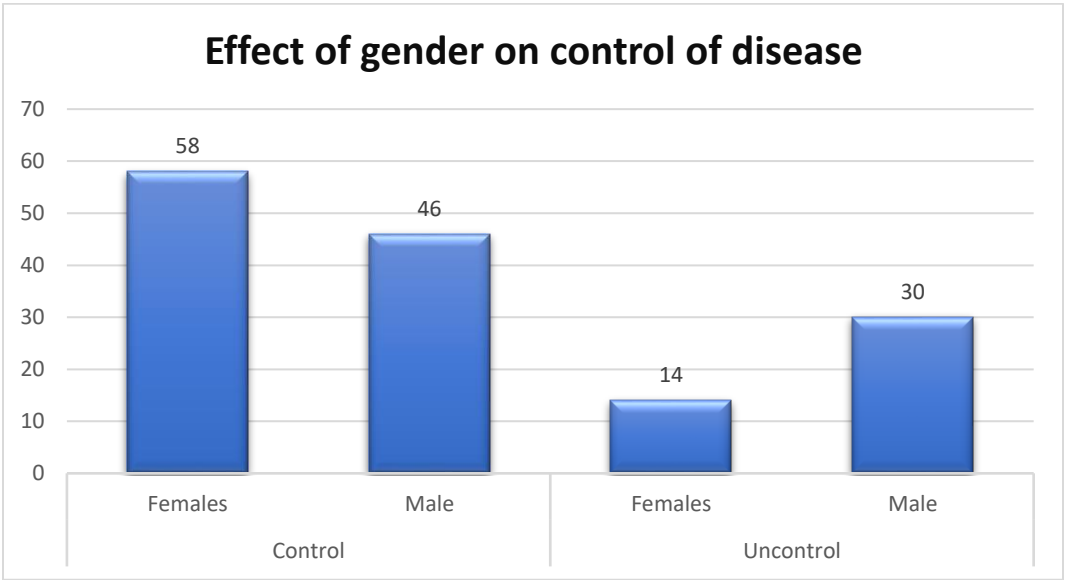


Figure 1 Pattern of disease control among different genders.

This graph illustrates the relationship between patient adherence to asthma treatment and asthma control, with a focus on gender differences. The Y-axis represents levels of patient adherence, categorized into numbers from zero to 70, where zero is minimum adherence and 70 was maximum adherence. The X-axis represents the degree of asthma control, in the form of control and uncontrol. The data highlights a notable gender discrepancy in patient adherence to asthma treatment. Females consistently demonstrate higher levels of adherence across all adherence categories compared to males. This higher adherence among females corresponds to better asthma control, with females exhibiting higher average asthma control scores within each adherence category. More information regarding patient adherence given below in (Figure 2).

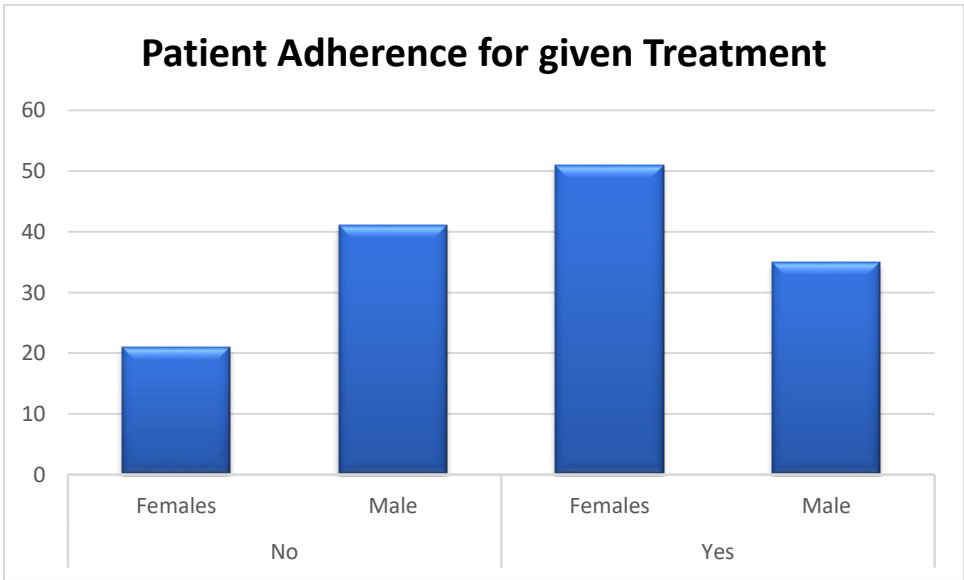


Figure 2 Pattern of Patient Adherence for given treatment.

#### 4. DISCUSSION

A number of patients who participated in this research were females, and their percentage was 56.2, Gender and disease control were shown to be significantly correlated, with a P value of 0.007 and an effect size of 0.222. Findings of the current study are quite similar to the study conducted in 2021 where the females have a piece of better knowledge as compared to the males and the study was conducted in Malaysia (Khan et al., 2021). According to a recent study done in Pakistan, women are better at controlling their Asthma than men are. As a result, the results of this study may agree with those of a recent study carried out in Pakistan (Iqbal et al., 2024). Patients aged 20 to 40 years have better control as compared to the patients of other age groups, and it was considered noteworthy with a P value of 0.001 and an effect size of 0.352.

The patients belonging to the ages of 61 and above had the least control over the disease, most likely explanation for this might be that elderly people tend to forget things more easily than younger individuals do. These present research results are consistent with our 2024 study done in Pakistan, which found that younger patients had better illness management than older patients (Iqbal et al., 2024). The impact of daily exercise was also evaluated by current research, and it is proven that the patients who are not doing daily exercise have better asthma control as compared to those who are buying exercise. Thus, exercise directly affects the control of Asthma and the significant association, and the prevalence was 0.042. The research conducted by Sara et al in Pakistan proves that exercise is a direct effect on Asthma and those who are doing the exercise will have less control of the disease hence the results of this investigation can also be compared to those of the earlier study (Shahid et al., 2024).

Quite strange and different kinds of findings are reported by grant study which revealed that smoking has a positive effect on control of Asthma which is actually contradicting with previous studies conducted on Asthma by different researchers and proven that smoking a detrimental impact on patients' ability to manage their Asthma, which is why this study released that if smoking was there the control of disease was 75.9% maybe the probable reason behind could be their less number of participants involved in smoking during Asthma that can lead to a false prediction about the smoking cessation on Asthma. Various previous studies have proven that smoking has a direct relation to the control of Asthma as well (Stapleton et al., 2011; Gemert et al., 2011). There is a clear correlation between the patient education variable and asthma control. As long as the education is increased among the patients, significant improvement in the control of the disease was observed with the evaluation of 0.001 and a phi value of 0.288.

Thus, it is proven that with the increase in education level, improvement of disease would be better. The probable reason behind this could be a better understanding of the disease with the increase of educational level in the patients. A similar kind of result findings was observed in a study conducted in the past, according to which the education level is directly related to the control of disease within the patients (Eagan et al., 2004). Obesity and overweight patients also have less control of disease, and the association was a direct positive association having an effect size of 0.311 and a P value of 0.001. This suggests that there is a rather substantial correlation between obesity and the management of a disease in current research. Similar kind of findings were also reported in the past in different areas of the world according that obesity has a direct relation with asthma control the increase in the rate of patients directly affects the control of the disease and vice versa (Shahid et al., 2024; Mohan et al., 2019).

Additionally, there is a clear correlation between patient adherence and asthma management in the current research sample. Which proves that if the adherence of a patient is more, the Disease Control of Asthma is also getting improved, an effect size of 0.230 and a value of 0.005 indicated a somewhat favorable connection. In line with the current findings of current research, a similar kind of reporting was there in the past where patient adherence was directly related to the control of a disease the more likely explanation for this would be patients' increased comprehension. about the disease and disease consequences thus the control of disease would be ultimately achieved (Lin et al., 2008).

#### 5. CONCLUSION

Overall, the current study proves that with a better understanding of the disease, control is getting better. The patients belong to age 20 to 40 years also have a better understanding of disease, and better treatment was observed. The increase in the education rate in patients will result in better control of disease and ultimately more adherence towards the disease, directly affecting the control of heart disease in the estimate.



### Limitations of the study

The study was conducted by competent pharmacists in various community pharmacies in Pakistan, a few patients from clinics and hospitals visited here to refill prescriptions. A study that influences follow-up on demographics of asthmatic patients and patterns of asthma drugs that are prescribed and used in Pakistan could be conducted here.

### Authors' Contributions

All the authors collaborate equally in this study. The final manuscript is read by all authors.

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### Conflict of interest

The authors declare that there is no conflict of interests.

### Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

## REFERENCES

1. Alolayan AMH. Prescribing Pattern of Asthma Therapy among Children with Asthma at Qassim Region, Saudi Arabia. *Pak J Med Health Sci* 2021; 15(6):2079–2083. doi: 10.53350/pjmhs211562079
2. Brigham EP, West NE. Diagnosis of asthma: diagnostic testing. *Int Forum Allergy Rhinol* 2015; 5(Suppl 1):S27-30. doi: 10.1002/alr.21597
3. Budreviciute A, Damiati S, Sabir DK, Onder K, Schuller-Goetzburg P, Plakys G, Katileviciute A, Khoja S, Kodzius R. Management and Prevention Strategies for Non-communicable Diseases (NCDs) and Their Risk Factors. *Front Public Health* 2020; 8:574111. doi: 10.3389/fpubh.2020.574111
4. Chatkin J, Correa L, Santos U. External Environmental Pollution as a Risk Factor for Asthma. *Clin Rev Allergy Immunol* 2022; 62(1):72-89. doi: 10.1007/s12016-020-08830-5
5. Cicco MED, Leone M, Scavone M, Miraglia-Del-Giudice M, Licari A, Duse M, Brambilla I, Ciprandi G, Caffarelli C, Tosca M. Intermittent and mild persistent asthma: how therapy has changed. *Acta Biomed* 2021; 92(S7):e2021523. doi: 10.23750/abm.v92iS7.12422
6. Cloutier MM, Teach SJ, Lemanske RF Jr, Blake KV. The 2020 Focused Updates to the NIH Asthma Management Guidelines: Key Points for Pediatricians. *Pediatr* 2021; 147(6):e2021050286. doi: 10.1542/peds.2021-050286
7. Danvers L, Lo DKH, Gaillard EA. The role of objective tests to support a diagnosis of asthma in children. *Paediatr Respir Rev* 2020; 33:52-57. doi: 10.1016/j.prrv.2019.02.001.
8. Devani P, Lo DKH, Gaillard EA. Practical approaches to the diagnosis of asthma in school-age children. *Expert Rev Respir Med* 2022; 16(9):973-981. doi: 10.1080/17476348.2022.2126355
9. Driscoll AJ, Arshad SH, Bont L, Brunwasser SM, Cherian T, Englund JA, Fell DB, Hammitt LL, Hartert TV, Innis BL, Karron RA, Langley GE, Mulholland EK, Munywoki PK, Nair H, Ortiz JR, Savitz DA, Scheltema NM, Simões EAF, Smith PG, Were F, Zar HJ, Feikin DR. Does respiratory syncytial virus lower respiratory illness in early life cause recurrent wheeze of early childhood and asthma? Critical review of the evidence and guidance for future studies from a World Health Organization-sponsored meeting. *Vaccine* 2020; 38(11):2435-2448. doi: 10.1016/j.vaccine.2020.01.020
10. Eagan TM, Gulsvik A, Eide GE, Bakke PS. The effect of educational level on the incidence of asthma and respiratory symptoms. *Respir Med* 2004; 98(8):730-736. doi: 10.1016/J.RM ED.2004.02.008
11. Eger KA, Bel EH. The emergence of new biologics for severe asthma. *Curr Opin Pharmacol* 2019; 46:108-115. doi: 10.1016/j.coph.2019.05.005
12. Gawali UP, Gholve PB, Rizvi SH, Mishra PS. Prescription pattern study of antiasthmatics drugs in tertiary care centre.



- Int J Basic Clin Pharmacol 2021; 10(4):429. doi: 10.18203/2319-2003.ijbcp20211028
13. Gemert FV, Van-der-Molen T, Jones R, Chavannes N. The impact of asthma and COPD in sub-Saharan Africa. *Prim Care Respir J* 2011; 20(3):240-8. doi: 10.4104/pcrj.2011.00027
  14. Gupta A, Gupta Y. Glucocorticoid-induced myopathy: Pathophysiology, diagnosis, and treatment. *Indian J Endocrinol Metab* 2013; 17(5):913-6. doi: 10.4103/2230-8210.117215
  15. Heffler E, Madeira LNG, Ferrando M, Puggioni F, Racca F, Malvezzi L, Passalacqua G, Canonica GW. Inhaled Corticosteroids Safety and Adverse Effects in Patients with Asthma. *J Allergy Clin Immunol Pract* 2018; 6(3):776-781. doi: 10.1016/j.jaip.2018.01.025
  16. Hei SJVD, Dierick BJH, Aarts JEP, Kocks JWH, Van-Boven JFM. Personalized Medication Adherence Management in Asthma and Chronic Obstructive Pulmonary Disease: A Review of Effective Interventions and Development of a Practical Adherence Toolkit. *J Allergy Clin Immunol Pract* 2021; 9(11):3979-3994. doi: 10.1016/j.jaip.2021.05.025
  17. Hu Z, Xuan J, Zhao H, Dong H, Yu C, Gao Y, Li L, Hu X, Xi CS. Treatment Patterns of Newly Diagnosed Asthma Patients in an Urban Setting in China: A Retrospective Longitudinal Real World Evidence Study. *Res Sq* 2021; 1. doi: 10.21203/rs.3.rs-207486/v1
  18. Iqbal MZ, Mubarak N, Fatima N, Zaheer L, Safdar A, Mansoor I, Fatima N, Iqbal Z, Razzaq A, Farooq T, Ahmad S, Saleem F, Maqsood M, Bukhari M, Noor N, Khan MA. The influence of sociodemographic factors on the control of blood glucose levels among diabetic outpatients visiting various community pharmacies in Lahore. *Med Sci* 2024; 28(145):e17ms3311. doi: 10.54905/disssi.v28i145.e17ms3311
  19. Kaur S, Bhagya MS, Prashant M. Drug Prescription Pattern in Pediatric Patients of Bronchial Asthma Attending Outpatient Department in a Private Hospital. *AJPRHC* 2020; 12(1):28-34. doi: 10.18311/ajprhc/2020/25261
  20. Khan AH, Iqbal MZ, Syed Sulaiman SA, Ibrahim A, Azmi NSBY, Iqbal MS, Albassam AA. Impact of Pharmacist-led Educational Intervention on Predictors of Diabetic Foot at Two Different Hospitals of Malaysia. *J Pharm Bioallied Sci* 2021; 13(1):108-115. doi: 10.4103/jpbs.JPBS\_475\_20
  21. Lin J, Sklar GE, Min-Sen-Oh V, Chuen-Li S. Factors affecting therapeutic compliance: A review from the patient's perspective. *Ther Clin Risk Manag* 2008; 4(1):269-86. doi: 10.2147/tcrm.s1458
  22. Mandlik DS, Mandlik SK. New perspectives in bronchial asthma: pathological, immunological alterations, biological targets, and pharmacotherapy. *Immunopharmacol Immunotoxicol* 2020; 42(6):521-544. doi: 10.1080/08923973.2020.1824238
  23. Mohan A, Grace J, Wang BR, Lugogo N. The Effects of Obesity in Asthma. *Curr Allergy Asthma Rep* 2019; 19(10):49. doi: 10.1007/s11882-019-0877-z
  24. Nunes C, Pereira AM, Morais-Almeida M. Asthma costs and social impact. *Asthma Res Pract* 2017; 3:1. doi: 10.1186/s40733-016-0029-3
  25. Padem N, Saltoun C. Classification of asthma. *Allergy Asthma Proc* 2019; 40(6):385-388. doi: 10.2500/aap.2019.40.4253.
  26. Papi A, Blasi F, Canonica GW, Morandi L, Richeldi L, Rossi A. Treatment strategies for asthma: reshaping the concept of asthma management. *Allergy Asthma Clin Immunol* 2020; 16:75. doi: 10.1186/s13223-020-00472-8
  27. Phan HT, Vu GV, Vu GT, Ha GH, Pham HQ, Latkin CA, Tran BX, Ho CSH, Ho RCM. Global Mapping of Research Trends on Interventions to Improve Health-Related Quality of Life in Asthma Patients. *Int J Environ Res Public Health* 2020; 17(10):3540. doi: 10.3390/ijerph17103540
  28. Rand CS, Wright RJ, Cabana MD, Foggs MB, Halterman JS, Olson L, Vollmer WM, Wilson SR, Taggart V. Mediators of asthma outcomes. *J Allergy Clin Immunol* 2012; 129(3 Suppl):S136-41. doi: 10.1016/j.jaci.2011.12.987
  29. Shahid S, Alqahtani SS, Bajwa M, Rashid M, Sana A, Bajwa A, Ali AN, Ariffin AK, Mahmood M, Ahmed F, Mustafa MA. The Effect of Obesity on Severity of Asthma: An Observational Prospective Study from Pakistan. *J Pharm Bioallied Sci* 2024; 16(1):38-43. doi: 10.4103/JPBS.JPBS\_238\_23
  30. Shimba A, Ikuta K. Control of immunity by glucocorticoids in health and disease. *Semin Immunopathol* 2020; 42(6):669-680. doi: 10.1007/s00281-020-00827-8
  31. Silver EM, Ochoa W. Glucocorticoid-Induced Myopathy in a Patient with Systemic Lupus Erythematosus (SLE): A Case Report and Review of the Literature. *Am J Case Rep* 2018; 19:277-283. doi: 10.12659/AJCR.906377
  32. Song HJ, Blake KV, Wilson DL, Winterstein AG, Park H. Medical Costs and Productivity Loss Due to Mild, Moderate, and Severe Asthma in the United States. *J Asthma Allergy* 2020; 13:545-555. doi: 10.2147/JAA.S272681
  33. Stapleton M, Howard-Thompson A, George C, Hoover RM, Self TH. Smoking and asthma. *J Am Board Fam Med* 2011; 24(3):313-22. doi: 10.3122/JABFM.2011.03.100180
  34. Toor JJV, Van-der-Mark SC, Kappen JH, In 't Veen JCCM, Braunstahl GJ. Mepolizumab add-on therapy in a real-world cohort of patients with severe eosinophilic asthma: response

rate, effectiveness, and safety. J Asthma 2021; 58(5):651-658.  
doi: 10.1080/02770903.2020.1723623

35. Upadhyay RK. Chronic Non-Communicable Diseases: Risk Factors, Disease Burden, Mortalities and Control. Acta Sci Med Sci 2022; 6(4):153–70. doi: 10.31080/asms.2022.06.1227